
First observations of a successful nest for the Endangered Mauritius Olive White-eye *Zosterops chloronothos*

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Le Zostérops de Maurice *Zosterops chloronothos* est le moins connu des huit espèces terrestres encore présentes à l'Île Maurice. La reproduction de l'espèce est très mal connue: seulement deux nids ont été bien documentés, et aucun des deux n'a produit des jeunes. En octobre 2000, un nid du Zostérops de Maurice contenant un oisillon d'un jour a été suivi jusqu'à l'émancipation du jeune. Les deux parents couvaient et nourrissaient l'oisillon, qui a quitté le nid à l'âge de 14 jours. Cinq jours après l'envol, le jeune a été vu en train de prospecter des branches à la recherche d'insectes; après trois semaines il se nourrissait de nectar. Il acquit le cercle orbital caractéristique et la longueur de queue adulte à l'âge de 33 jours. A partir de ce moment, il n'y avait plus de différence entre les plumages adulte et juvénile. Les adultes ont progressivement diminué le nombre de nourrissages du jeune pendant les deux mois suivants. Les premiers signes d'agressivité parentale ont été observés 58 jours après l'envol; cette agressivité a continué pendant trois jours consécutifs. La période de dépendance juvénile a duré 61 jours, après laquelle le jeune a quitté la zone natale et n'a plus été observé en compagnie des parents.

White-eyes, Zosteropidae, constitute a large family of passerines present throughout Asia, Australasia, Africa, and western Pacific and western Indian Ocean islands. Of the c85 species, over 30% are of conservation concern¹. Mauritius Olive White-eye *Zosterops chloronothos* is one of three threatened white-eyes in the western Indian Ocean and is currently considered Endangered¹. The population has drastically declined from an estimated 340–350 pairs in 1975² to an estimated 93–148 pairs in 2001⁵. The main threats are habitat loss, degradation of native habitat and intense nest predation by introduced mammals^{2,7}. Only 5% of native forest remains on Mauritius, all in a very degraded state⁸. Nesting success of the white-eye is extremely low at 7–17%⁶, and introduced monkeys, *Macaca fascicularis*, and rats, *Rattus rattus*, are a major cause of passerine nesting failures in Mauritius^{2,3,9}.

Observations of Mauritius Olive White-eye breeding biology are extremely rare due to its low numbers, transient nature and elusive nesting habits^{2,10}. The species' monomorphic features makes it very difficult to distinguish male, female and juvenile plumages in the field. Prior to 1998, only two nests had been documented^{10,11} (both predated) and there had been no confirmed sightings of juveniles or fledglings. This paper documents the first recorded successful nest of *Z. chloronothos* and

details for the first time, fledging and juvenile dependency periods, and the role of the adults in parental care, as well as providing the first photographs of a nest and nestling.

Nest

No birds were present in the area when the nest was discovered, which was initially suspected to belong to either the common Mauritius Grey White-eye *Zosterops borbonicus mauritianus* or a Mascarene Paradise Flycatcher *Terpsiphone bourbonensis desolata* because of its size, materials, nest tree species and height above ground. A newly hatched chick was present in the nest, which was lined with feathers suggesting that it might belong to a pair of Olive White-eye, as *Z. chloronothos* lines the nest with feathers and *Z. b. mauritianus* does not^{2,10}. After four minutes, two adult Olive White-eyes returned to the area, the first landed beside the nest and the other fed the chick.

Location

The nest was found at Combo, an area of c5 km² in the south-east of Black River Gorges National Park. The nest tree was 2 m from an overgrown abandoned road within a small patch (8 m x 7 m) of Guava *Psidium cattleianum*. The nest was 2 m above ground in the fork of a Guava, and was woven to the trunk in the tree's upper part, having



Figure 1. Adult Mauritius Olive White-eye *Zosterops chloronothus* brooding the nestling, Combo, Mauritius, October 2000 (Rina Nichols)



Figure 2. Adult Mauritius Olive White-eye *Zosterops chloronothus* feeding the nine-day old nestling, Combo, Mauritius, October 2000 (Rina Nichols)



Figure 3. Adult Mauritius Olive White-eye *Zosterops chloronothus* preening near its nest, Combo, Mauritius, October 2000 (Rina Nichols)



Figure 4. Adult Mauritius Olive White-eye *Zosterops chloronothus* nectar-feeding, Pétrin, Mauritius (Dennis Hansen)

three points of contact. The location and position made it possible to conduct 49.5 hours of observations from the discovery date, on 10 October, until the chick successfully fledged on 23 October 2000. Most observations were conducted after the nestling was three days old. The nest's accessibility also made it possible to band and measure the nestling.

Description

The outer cup was primarily constructed (in order of abundance) of green moss, dried leaves and grass, small twigs, lichen, feathers, spider egg casings, fern leaf scales and a cotton-like plant material. The inner cup consisted primarily of narrow dried grass, grass heads and moss seta. The nest was lined with ten feathers, two of which were body feathers

of the globally threatened Pink Pigeon *Columba mayeri*, four were body feathers of Olive White-eye and the remaining four were not identified. The outer cup measured 63.4 mm in width (w), 80.3 mm in length (l) and 65.4 mm in depth (d). The inner cup was 47.1 mm (w) by 56.4 mm (l) by 39.5 mm (d). The walls were 9.1 mm to 13.6 mm thick. The nest was collected on 29 October, one week after the nestling had fledged and the adults were no longer visiting it. The nest is currently in the possession of Dr Carl Jones, Scientific Director of the Mauritian Wildlife Foundation, who plans to deposit it in the Natural History Museum, Tring, UK.

Nestling

The nestling was estimated to be one day old when the nest was found on 10 October, and was pink, completely naked and c2 cm long. The gape was bright yellow. No hatched eggshells or unhatched eggs were present in the nest, suggesting that all pieces of eggshell and perhaps even infertile eggs were removed from the nest very soon after the nestling hatched.

Fledging period

Prior to this study, fledging period and parental roles in chick rearing were unknown for this species. The first three days of observations were irregular, as it was not known how the pair would react to observer presence. After three days, observations were gradually increased and appeared to have a negligible effect on the pair. By the seventh day it was possible to distinguish between the adults

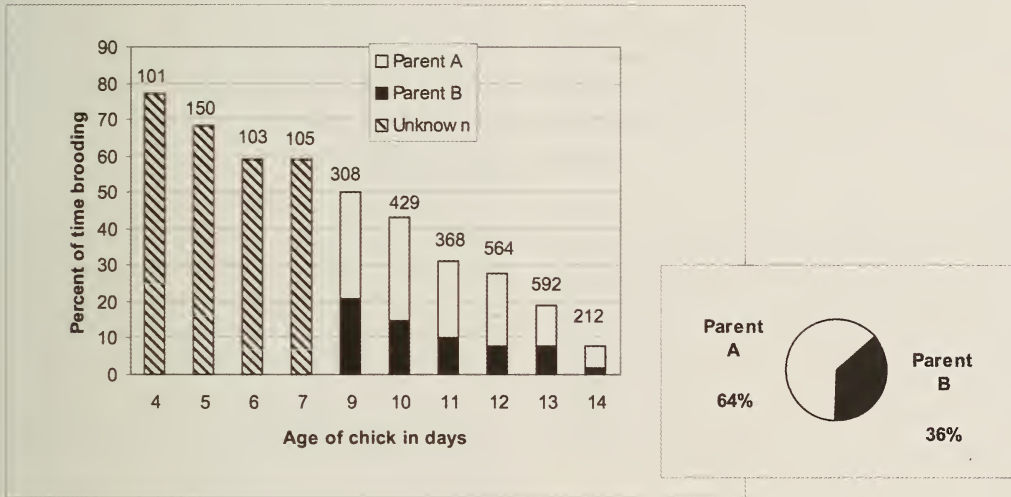


Figure 6. Bar graph depicting percentage of each day the adults spent brooding the nestling between day 4 and fledging on day 14. 'Unknown' refers to observations in which parents A and B could not be separated. The total number of minutes the nest was observed on each day is presented above the relevant bar. The pie chart compares the percentage of time spent by parents A and B brooding the nestling on days 9–14.

Table 1. Growth of a Mauritius Olive White-eye *Zosterops chloronothos* nestling at Combo.

Date (age in days)	Bill gape to tip (mm)	Wing chord (mm)	Feathers	Proportion of body covered in pin feathers and down	Comments
15 October 2000 (six)	9.6	14	Body and primaries all in pin	30% of body covered in pin feathers; no down	Banded red (right leg); chick in very good condition
17 October 2000 (eight)	10.5	23	Distal 3 mm of primaries out of pin	40% of body covered in pin feathers; no down	Gape and tongue bright yellow; eyes closed
18 October 2000 (nine)	10.6	28	Distal 5 mm of primaries out of pin	75% of body covered in pin feathers; no down	Eyes closed; first observation of adults removing faecal sac from nest
19 October 2000 (ten)	11.0	31.5	Distal 8 mm of primaries out of pin	90% of body covered in feathers out of pin; 20% of body covered in down	Eyes just opening; nest clean, parents removing faecal sacs from nest
20 October 2000 (11)	—	36	18 mm (50%) of primaries out of pin	90% of body covered in feathers out of pin; 70% of body covered in down	Eyes fully open; nestling still naked and pink on sides under wing

(though sex was unknown) as they sat in different positions and behaved differently while at the nest. Whenever possible the observer distinguished between parent A and B. This permitted observations of the parental roles during chick rearing.

Several white-eyes in the Indian Ocean, including the sympatric Mauritius Grey White-eye, possess a cooperative breeding strategy, with several 'helpers' feeding nestlings at one nest^{2,3,6}. The young of this Olive White-eye pair, and four other pairs observed from 1998 to 2001, were fed and brooded only by the parents³. The fledging period for the chick observed in this study was 14 days. Fledging period in Seychelles White-eye *Zosterops modesta* is 11–16 days⁶. It is probable that Mauritius Olive White-eye also exhibits individual variation in fledging period.

Brooding

Both male and female brooded the nestling. When the nestling was four days old the parents brooded 77% of the time. The proportion of time gradually decreased until by day 14 the parents brooded 8% of the time (Fig 6). Parent A brooded the nestling for two-thirds of the time (Fig 6). It is unknown which sex undertook most of the brooding, but hopefully this can be confirmed by future studies.

Feeding

When the adults arrived at the nest they called to

the nestling with a soft *pip* and the nestling immediately began begging. Both sexes fed the nestling. The parents fed the young a mean 7.8 times per hour when the chick was four days old, and this average peaked at 19 times per hour on day 11 (Fig 7). For Seychelles White-eye feeding frequency varied between seven and 16 feeds per hour⁶. There was a noticeable increase in the number of feeding visits per hour after day 7 by the Olive White-eyes we observed. The most feeds recorded in one hour was on day 11, when the parents fed the nestling 36 times between 14.30 and 15.30 hrs. The nestling was fed equally by both sexes (Fig 7). It was not possible to distinguish species of invertebrate being fed to the chick, except for occasional glimpses of a dragonfly wing and beetle carapace.

Nestling growth

The nestling was banded in the nest on day 6. Mensural data were taken while the nestling was growing (Table 1) from day 8 (when it was removed from the nest for this purpose). Thereafter, measurements were taken while the nestling was in the nest. The primary feathers grew at a rate of 4.5–5.0 mm per day on days 6–11. Feather growth was most noticeable after day 8, coinciding with a marked increase in the number of feeding visits by the adults. The parents were first observed to remove a white faecal sac from the nest on day 9.

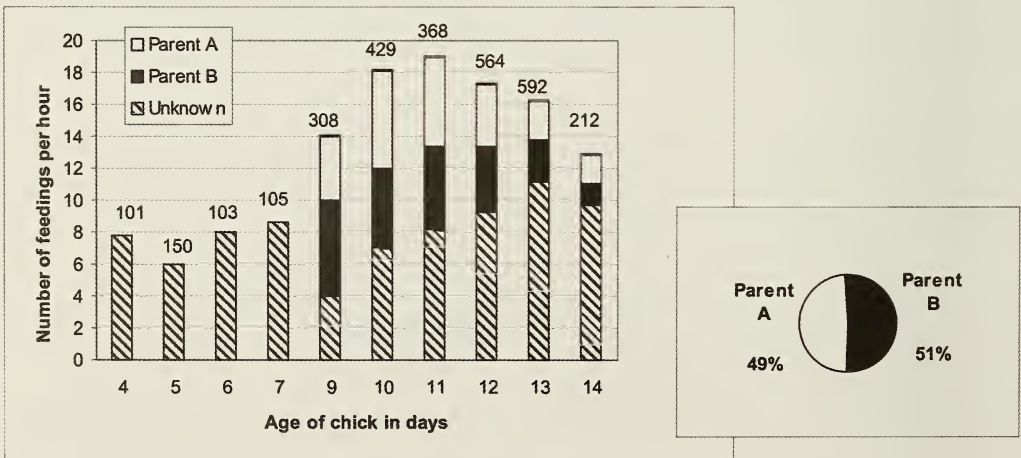


Figure 7. Bar graph depicting the mean number of feeding visits per hour on days 4–14 (when the chick fledged). 'Unknown' refers to observations in which parents A and B could not be separated. The total number of minutes the nest was observed on each day is presented above the relevant bar. The pie chart compares the percentage of time spent by parents A and B feeding the nestling on days 9–14.

The nestling's eyes started to open on day 10 and were fully open next day. Thereafter, no additional measurements were taken. By day 10 the adults were leaving the nestling untended in heavy rain, and the nestling was also first noted self-preening on the same day. By day 12, the olive coloration to the primaries and uppertail-coverts was visible, and the yellow gape was much less pronounced.

Fledging

At 15.30 hrs on day 13 the adults were observed attempting to entice the nestling from the nest. On returning to the area they did not feed the nestling but called to it whilst perched 2 m away. This occurred three times in the afternoon, each time for a minimum of three minutes. The nestling responded actively and perched on the edge of the nest vigorously flapping its wings, but did not leave the nest. On day 14 the enticing behaviour commenced at 08.00 hrs and occurred four times over the next 110 minutes. At 09.50 hrs the nestling moved to a small branch 30 cm above the nest. The primary flight feathers were full and in good condition, but the tail feathers were not yet visible.

Juvenile dependency period

At least one adult remained with the young for the first 30 minutes after fledging, during which time the chick was preened almost continuously by one or both parents. The fledgling was fed seven times by the adults in the first 30 minutes and did not return to the nest. However, an adult returned to the nest on two occasions and sat in the nest for 30 seconds on each visit. The fledgling moved only 5 m from the nest during the first day. It made several attempts to follow the parents but these were unsuccessful. The parents returned to the fledgling every 6–10 minutes. Twice, the adults alarm-called, to which the fledgling immediately reacted, remaining quiet and still until the parents returned.

For the next 1.5 days the fledgling remained perched 10–15 m from the nest in exotic bamboo and Japanese Red Cedar *Cryptomeria japonica*. The adults returned every 10–15 minutes and preened the fledgling every third or fourth visit. The fledgling made very short flights during the first two days. On the third day, the parents and fledgling were found 25 m from the nest in a patch of bamboo. The adults were still feeding the fledgling as frequently as every ten minutes, but also left the fledgling for longer periods of up to 25 minutes.

Five days after the nestling fledged, the parents and fledgling were observed 50 m from the nest in a patch of exotic Rose-apple *Syzigium jambos*, near the edge of a stream. The fledgling was observed for the first time gleaning branches for insects and invertebrates, mutual preening with the adults and flying with them over several metres. The tail feathers were noticeably longer, approximately half the length of the adult tail. The parents fed the fledgling up to seven times per 30 minutes but occasionally did not feed the young for up to 40 minutes.

For the first two weeks after fledging the adults still continued to feed the young up to five times per 30 minutes. Fifteen days after fledging the white eye-ring of the young was full, confirming that fledgling Olive White-eyes have complete eye-rings within c2 weeks of fledging. The fledgling acquired full adult tail length by 19 days after fledging making it very difficult to distinguish between adult and young plumage at this point. The fledgling continued to beg often, wing flapping and following the adults. On the 21st day after fledging the young was observed for the first time nectar-feeding from *S. jambos*, and was observed feeding alone for up to one hour, albeit with the parents still close by.

After 1 December the adults responded much less frequently to begging behaviour. The fledgling received food less than 50% of the time it begged. However, this did not appear to affect the social dynamics of the trio, as they continued to mutual preen at least once every two hours. On day 58 after fledging the first observation was made of one of the adults chasing the young from the natal area and this behaviour was observed several times during the next few days. By 22 December, after 61 days of juvenile dependency, the fledgling was no longer observed with the parents. The young was observed several times in an area adjacent to the adults' territory. Several searches for the juvenile in and around the natal area in January were unsuccessful, suggesting the young had dispersed further away.

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